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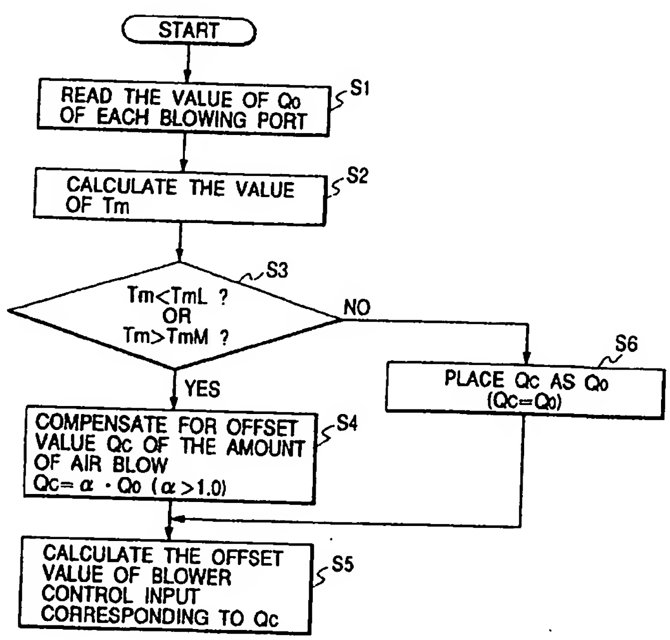
(54) Air conditioning apparatus for vehicle

(57) An air conditioning apparatus for a vehicle is constituted by including a blower (5) provided in the air conditioning duct of vehicle, a blower motor for driving the blower, a motor control circuit for controlling the voltage applied to the blower motor and a microcomputer (11) for controlling the air blow rate of the blower via the motor control circuit. The microcomputer calculates the air blow-out port temperature T_m of each air conditioning duct, compares this temperature with the previously stored first and second reference temperature T_{mL}, T_{mH}, calculates the offset value of the air blow rate of the blower depending on the previously stored calculation formula when the condition is determined as $T_m < T_{mL}$ or $T_m > T_{mH}$ and also calculates, from the relevant offset value, the offset value of the blower control input applied to the blower motor from the motor control circuit.

FIG. 5



EP 1 134 101 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an air conditioning apparatus for a vehicle and particularly to an air blow rate control means for the blower provided within the air conditioning duct of vehicle.

Description of the Related Art

[0002] As is known, an air conditioning duct of vehicle is provided with a blower for sucking the external air into the vehicle and circulating the air within the vehicle, an evaporator for cooling and dehumidifying the air transferred with the blower, a heater and an air mixing flap for regulating the blow rate of air to the heater. The air cooled and dehumidified with the evaporator is then heated with the heater and distributed to each air blow-out port within the vehicle.

[0003] The air blow-rate of the blower is controlled with a microcomputer via a blower motor control circuit. Namely, the microcomputer calculates the temperature of air blown out from each air blow-out port from the temperature in the vehicle set by a user (preset temperature), air blow rate of the blower, outside temperature and amount of sunlight measured with sensors and vehicle speed or the like. Moreover, when the calculated temperature at the air blow-out port is higher than or equal to the first reference temperature and is lower than or equal to the second reference temperature, for example, when such temperature is within the temperature range higher than or equal to 10°C but lower than or equal to 70°C, the microcomputer outputs, to a blower motor control circuit, an instruction depending on the temperature difference between the preset temperature and vehicle compartment temperature measured with a sensor, depending on the blower control data previously stored in the microcomputer and then applies a blower control input (voltage value) depending on such temperature difference to a blower motor from the blower motor control circuit in view of adjusting the blow rate of the blower to the value depending on the temperature difference.

[0004] On the occasion of adjusting a blow rate of the blower depending on the instruction from the microcomputer, if blowing of air from the blower is perfectly stopped when the difference between the preset temperature and vehicle compartment temperature becomes zero or when the difference between the preset temperature and vehicle compartment temperature is set within the predetermined temperature range, disadvantages such as freezing of evaporator and burning of contacts due to the frequency ON/OFF switching operation of the blower may be generated easily.

[0005] Therefore, in order to eliminate such disadvantages in the related art, there is proposed a technique, as illustrated in Fig. 8, that the predetermined value Cf_o' of the blower control input Cf corresponding to the predetermined blow rate is applied to the blower motor in order to supply the air of the predetermined blow rate to the evaporator even within the predetermined temperature range ($-T_D < T_e < T_D$). In this specification, this predetermined blow rate is called the "offset value of blow rate" and the corresponding blower control input is called the "offset value of blower control input" . The blower control input is uniquely calculated from the blow rate with the predetermined conversion formula.

[0006] However, the technique in relation to the related art explained above has a problem that since the range of the temperature T_m at the air blow-out port that is controlled in the blow rate of the blower depending on the blower control data previously stored in the microcomputer is previously set to the particular temperature range, for example, to the temperature range higher than or equal to 10°C but lower than or equal to 70°C, if the calculated temperature T_m at the air blow-out port exceeds the previous temperature range, it is impossible to execute the blow rate control of the blower depending on the blower control data and moreover since the offset value of the blow rate is fixed without relation to the temperature T_m of the air blow-out port and therefore the offset value Cf_o' of the blower control input is fixed, if the calculated temperature T_m at the air blow-out port high or low enough for exceeding the temperature range explained above, it is difficult to stably keep the vehicle compartment temperature at the set temperature.

SUMMARY OF THE INVENTION

[0007] The present invention has been proposed to overcome the subjects explained above and an object of the present invention is to provide an air conditioning apparatus for a vehicle that can automatically change the offset value of the blower control input depending on the calculated temperature at the air blow-out port in view of quickly raising or falling the vehicle compartment temperature to the set temperature and stably maintaining the vehicle compartment temperature to the set temperature.

[0008] In view of solving the subjects explained above, the present invention discloses an air conditioning apparatus for a vehicle, comprising a blower provided within a air conditioning duct in the vehicle, a blower motor for driving the blower, a motor control circuit for controlling a voltage applied to the blower motor and a microcomputer for controlling the air blow rate of the blower via the motor control circuit, wherein the microcomputer calculates temperature of air

at the air blow-out port of the air conditioning duct, compares the calculated temperature of air at the air blow-out port with a first and a second reference temperatures previously stored and then calculates , when the temperature of air at the air blow-out port is lower than the first reference temperature or higher than the second reference temperature, an offset value of the air blow rate of the blower depending on the previously stored calculation formula and also calculates an offset value of the blower control input corresponding to the offset value of the air blow rate.

[0009] When the corresponding offset value of the blower control input is obtained from the calculated temperature (T_m) at the air blow-out port and the blow rate from the blower is raised by controlling the blower motor with the motor control circuit, the vehicle compartment temperature (T_i) can be stably maintained at the set temperature (T_s), even when the calculated temperature (T_m) at the air blow-out port is low or high enough for exceeding the first reference temperature or the second reference temperature and heat radiation from vehicle compartment or heat absorption in the vehicle compartment is extremely high.

[0010] In an air conditioning apparatus for a vehicle explained above, the offset value of the air blow rate can be proportionally controlled depending on the difference between the calculated temperature at the air blow-out port and the first reference temperature or second reference temperature.

[0011] Thereby, since the necessary offset value of the air blow rate, and moreover the offset value of the blower control input can be obtained only by multiplying the preset offset value of air blow rate with a coefficient determined on the basis of the calculated temperature at the air blow-out port, the air blow rate can be quickly controlled depending on the temperature at the air blow-out port.

[0012] Moreover, in the air conditioning apparatus for vehicle explained above, the first reference temperature and the second reference temperature can respectively be set, with the microcomputer, to the temperature lower than or equal to the minimum temperature (for example, 10°C) and to the temperature higher than or equal to the maximum temperature (for example, 70°C) for the control of blower control input.

[0013] Thereby, even when the calculated temperature (T_m) at the air blow-out port exceeds the predetermined temperature range (for example, not lower than 10°C but not higher than 70°C) for the control of blower control input, the blower control input can be controlled and thereby the apparatus can be operated under the considerably severe environment.

[0014] Moreover, in the air conditioning apparatus for vehicle explained above, the blower control input can be proportionally controlled in the multiple stages depending on the difference between the set temperature and the vehicle compartment temperature.

[0015] Thereby, when the temperature difference (T_e) between the set temperature (T_s) and vehicle compartment temperature (T_i) is large, the air blow rate of blower can be set large depending on such difference and when such temperature difference (T_e) is, on the contrary, small, the air blow rate of blower can be set small depending on such difference. Therefore, the vehicle compartment temperature can be raised or lowered quickly up to the set temperature.

[0016] In addition, in the air conditioning apparatus for vehicle, the upper limit value of the blower control input can be proportionally controlled depending on the temperature of engine coolant.

[0017] Thereby, even when a user sets the vehicle compartment temperature to a higher value under the condition that the temperature condition in the vehicle is the heat absorbing condition and the temperature of engine coolant is low, the cool air is never intensively blown out to the vehicle compartment and thereby unpleasant feeling of user can be alleviated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Fig. 1 is a structural diagram of an air conditioning duct provided within the vehicle.

[0019] Fig. 2 is a block diagram of the blower motor control apparatus.

[0020] Fig. 3 is a graph illustrating the relationship between a temperature difference between the set temperature and vehicle compartment temperature and the blower control input.

[0021] Fig. 4 is a graph illustrating the relationship between the engine coolant temperature and blower control input.

[0022] Fig. 5 is a flowchart illustrating the procedures for compensating for the offset value of the blower control input.

[0023] Fig. 6 is a graph illustrating the relationship between the air blow-out port temperature and the offset value of the air blow rate.

[0024] Fig. 7 is a graph illustrating the compensated blower control mode.

[0025] Fig. 8 is a graph illustrating known blower control mode of the related art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0026] An embodiment of the air conditioning apparatus for vehicle of the present invention will be explained with reference to Fig. 1 to Fig. 7. Fig. 1 is a structural diagram of an air conditioning duct provided within a vehicle. Fig. 2 is a block diagram of a blower motor control apparatus. Fig. 3 is a graph illustrating the relationship of a temperature

difference between the set temperature and vehicle compartment temperature and the blower control input. Fig. 4 is a graph illustrating a relationship between the engine coolant temperature and blower control input. Fig. 5 is a flowchart illustrating a procedure for compensating for the offset value of the blower control input. Fig. 6 is a graph illustrating a relationship between the temperature at the air blow-out port and the offset value of the blower control input. Fig. 7 is a graph illustrating the blower control mode after the offset value compensation in comparison with the blower control mode before the offset value compensation.

[0027] The air conditioning duct of this embodiment is formed of a driver's seat side duct and an assitant's seat side duct. Each duct of respective seats is provided with an external air intake port 1, an internal air intake port 2, a direct cool air blow-out port 3 and a direct blow-out port 4 of the air mixing the cool and warm airs. Among the external air intake port 1, internal air intake port 2 and direct cool air blow-out port 3, a blower 5 for taking external air or circulating the internal air and an evaporator 6 for cooling and dehumidifying the blowing air from the blower 5 are provided and a heater 7 is also provided between these blower 5, evaporator 6 and the air blow-out port 4 for the air mixing the cool and warm airs. Moreover, the external air intake port 1 is provided with a first flap 8 for switching the intake of the external air and internal air, a flowing path of the air mixing the cool and warm airs is provided with a second flap 9 for adjusting temperature of the air mixing the cool and warm airs and an air blow-out port 4 for the air mixing the cool and warm airs is provided with a third flap 10 for switching the blowing out direction for the air mixing the cool and warm airs to, for example, the front, rear directions and to the defroster or the like. The blower 5 is also provided with a blower motor 5a (refer to Fig. 2) and an output of the blower 5, namely a blow rate of the blower 5 can be adjusted by controlling a voltage value applied to the relevant motor (blower control input).

[0028] As illustrated in Fig. 2, the control apparatus of the blower 5 is constituted of inclusion of a microcomputer 11, a vehicle compartment temperature setting means 12, a vehicle compartment temperature measuring means 13, an external air measuring means 14, a sun load measuring means 15, a vehicle speed measuring means 16, an engine coolant temperature measuring means 17 and a motor control circuit 18 for outputting the predetermined blower control input to the blower motor 5a depending on an instruction from the microcomputer 11. The microcomputer 11 is provided with a first to third memories 11a, 11b and 11c.

[0029] Here, the data illustrated in Fig. 3, namely the data indicating the correlation of the temperature difference Te between the set temperature T_s and vehicle compartment temperature T_i when the air blow-out port temperature T_m is in the predetermined temperature range (for example, not lower than 8°C but not higher than 72°C) and the blower control input Cf is stored in the first memory 11a, a control flow of the offset value of Fig. 5 is stored in the second memory 11b and the predetermined constants required for calculation and the calculation formula, for example, the calculation formula for calculating the offset value Q_o of the predetermined air blow rate, predetermined coefficients α and α_1 to α_4, the first reference temperature T_{mL} and second reference temperature T_{mH} as the threshold values for compensating for the offset value of the blower control input and the air blow-out port temperature T_m and the calculation formula for calculating the offset value Q_c of the air blow rate depending on the air blow-out port temperature T_m are stored in the third memory 11c.

[0030] Here, the first reference temperature T_{mL} and second reference temperature T_{mH} can be set, with the microcomputer 11, respectively to the temperature lower than or equal to the minimum temperature (for example, 10°C) and the temperature higher than or equal to the maximum temperature (for example, 70°C) enough for the control of the blower control input depending on the mode illustrated in Fig. 3. Thereby, even when the calculated air blow-out port temperature T_m exceeds the predetermined temperature range for the control of blower control input with the microcomputer 11, the blower control input can also be controlled and thereby the apparatus can be operated even under the considerably severe environment.

[0031] The calculation formula for calculating the air blow-out port temperature T_m is expressed with the following first formula when the air blow-out port temperature is defined as T_m, set temperature set with the vehicle compartment temperature setting means 12 as T_s, external temperature measured with the external temperature measuring means 13 as T_a, a sun load measured with the sun load measuring means 14 as S , vehicle speed measured with the vehicle speed measuring means 15 as V, an offset blow rate determined with the air blow-out port as Q_o and coefficients as α_1 to α_4.

[Formula]

$$\mathrm{Tm} = \frac{\alpha_1 \cdot (Ts - Ta) - \alpha_2 \cdot S + \alpha_3 \cdot V \cdot (Ts - Ta)}{\alpha_4 \cdot Q_0} + Ts \qquad (1)$$

[0032] On the other hand, the calculation formula for calculating the offset value Q_c of the air blow rate depending on the air blow-out port temperature T_m is expressed with the following second formula when the offset value of the preset blow rate is defined as Q_o, offset value of blow rate after compensation with calculation as Q_c and the coefficient determined based on the air blow-out port temperature T_m as α (where, $\alpha > 1.0$).

[Formula 2]

$$Q_c = \alpha ? Q_0 \quad (2)$$

[0033] According to the second formula, since the offset value Q_c of the air blow rate after compensation can be calculated only with multiplying the offset value Q_o of the preset air blow rate with the coefficient α determined on the basis of the air blow-out port temperature T_m, the quick control of air blow rate depending on the air blow-out port temperature T_m is now possible.

[0034] The data of Fig. 3 indicates the blower control mode by the microcomputer 11 and graduates a temperature difference T_e between the set temperature T_s and the vehicle compartment temperature T_i on the lateral axis, while the blower control input Cf on the vertical axis. As will be apparent from this figure, the blower control input Cf is proportionally controlled in the multiple stages depending on the temperature difference T_e. That is, when the temperature difference T_e is in the range of $-T_{D1} \leqq T_e \leqq T_{D1}$, the blower control input Cf_o to obtain the blow rate corresponding to the predetermined offset value Q_o is applied to the blower motor 5a from the motor control circuit 18 and when the temperature difference Te is in the range of $-T_{D2} \leqq T_e < -T_{D1}$ or $T_{D1} < T_e \leqq T_{D2}$, the blower control input Cf applied to the blower motor 5a from the motor control circuit 18 is adjusted with the proportional constant of the lower absolute value expressed with the straight line A, and when the temperature difference T_e is in the range of $-T_{D3} \leqq T_e < -T_{D2}$ or $T_{D2} < T_e \leqq T_{D3}$, the blower control input Cf applied to the blower motor 5a from the motor control circuit 18 is adjusted with the proportional constant of the high absolute value expressed with the straight line B. Moreover, when the blower control input Cf is in the range of $T_e < -T_{D3}$ or $T_{D3} < T_e$, the blower control input Cf_1 of constant level is applied to the blower motor 5a from the motor control circuit 18.

[0035] As explained above, since the air conditioning apparatus of the present embodiment proportionally controls in the multiple stages the blower control input Cf applied to the blower motor 5a depending on the difference between the set temperature and vehicle compartment temperature, when the temperature difference T_e between the set temperature T_s and vehicle compartment temperature T_i is large, the air blow rate of the blower can be increased depending on such temperature difference and when the temperature difference T_e is small, on the contrary, the air blow rate can be decreased depending on such difference. Accordingly, the vehicle compartment temperature T_i can quickly be raised or lowered up to the set temperature T_s.

[0036] The blower control input Cf_1 applied to the blower motor 5a from the motor control circuit 18 when the temperature difference T_e is in the range of $T_e < -T_{D3}$ or $T_{D3} < T_e$ is set to the value proportional to the engine coolant temperature. Namely, as illustrated in Fig. 4, the blower control input Cf_1 is set to the minimum value (C_o) for driving the blower motor 5a when the engine coolant temperature Tw is less than the predetermined lower threshold value Tw_o. When the engine coolant temperature rises exceeding the lower threshold value Tw_o, the value of blower control input Cf_1 rises in proportional to the engine coolant temperature and after the engine coolant temperature exceeds the predetermined upper threshold value Tw_1, the blower motor 5a is set to the rated value (maximum value). Thereby, even when a user sets the vehicle compartment temperature to a higher value under the condition that the temperature condition within the vehicle is in the heat absorbing condition and the engine coolant temperature is low, the cool air is never blown intensively and unpleasant feeling of user can be alleviated.

[0037] Operations of the air conditioning apparatus of this embodiment will be explained depending on the flowchart of Fig. 5.

[0038] In the step S1 of Fig. 5, the offset value Q_o of the air blow rate stored in the third memory 11c is read.

[0039] Next, in the step S2 of Fig. 5, the air blow-out port temperature T_m of each blow-out port of each duct is calculated on the basis of the first formula stored in the third memory 11c.

[0040] In the step S3 of Fig. 5, the threshold values T_{mL} and T_{mH} stored in the third memory 11c are compared with the air blow-out port temperature T_m.

[0041] In the step S3, when the condition of $T_m < T_{mL}$ or $T_m > T_{mH}$ is determined, the process shifts to the step S4 of Fig. 5 to calculate the offset value Q_c of the air blow rate after the compensation based on the second formula stored in the third memory 11c. Thereafter, shifting to the step S5 of Fig. 5, the blower control input Cf required to obtain the air blow rate corresponding to the offset value Q_c after the compensation is calculated. Thereby, the offset value Cf_c of the blower control input Cf is compensated as illustrated in Fig. 6 depending on the air blow-out port temperature T_m and the air conditioning is conducted within the vehicle in the compensated blower control mode indicated with a broken line of Fig. 7.

[0042] In the step S3, when condition of $T_m > T_{mL}$ or $T_m < T_{mH}$ is determined, the process shifts to the step S6 of Fig. 5 and Q_c is placed as Q_o ($Q_c = Q_o$). Thereafter, shifting to the step S5 of Fig. 5, the blower control input Cf_o required to obtain the air blow rate of the predetermined offset value Q_o is calculated. In this case, the air conditioning in the vehicle is conducted in the blower control mode of Fig. 3.

[0043] The air conditioning apparatus for vehicle of this embodiment calculates, with a microcomputer 11, the air blow-out port temperature T_m of the air conditioning duct and compensates for the air blow rate by obtaining the offset value of the blower control input Cf to be applied to the blower motor 5a. Therefore, even when the calculated air blow-out port temperature is low or high exceeding the first reference temperature T_{mL} or second reference temperature T_{mH} and heat radiation from the vehicle or heat absorption in the vehicle is excessive, the vehicle compartment temperature can be maintained at the set temperature.

[0044] An air conditioning apparatus for a vehicle of the present invention calculates the air blow-out port temperature of the air conditioning duct with a microcomputer and compensates for the air blow rate by obtaining the offset value of the blower control input applied to the blower motor from the calculated air blow-out port temperature and therefore can stably maintain the vehicle compartment temperature to the set temperature even when the calculated air blow-out port temperature is low or high exceeding the first reference temperature and second reference temperature and heat radiation from the vehicle or heat absorption in the vehicle is excessive.

[0045] Further, an air conditioning apparatus for a vehicle of the present invention proportionally controls the offset value of the air blow rate depending on the difference between the calculated air blow-out port temperature and the first reference temperature or second reference temperature and therefore can obtain the offset value of the predetermined air blow rate only by multiplying the calculated air blow-out port temperature with the predetermined coefficient to enable the quick control of the air blow rate depending on the air blow-out port temperature.

[0046] Still further, an air conditioning apparatus for a vehicle of the present invention respectively sets the first reference temperature and second reference temperature to the temperature lower than or equal to the minimum temperature and the temperature higher than or equal to the maximum temperature for the control of the blower control input with a microcomputer and therefore can control the air blow rate of blower and operate even under the severe environment even when the calculated air blow-out port temperature exceeds the predetermined temperature range when the blower control input is controlled with the microcomputer.

[0047] Still further, an air conditioning apparatus for a vehicle of the present invention proportionally controls the air blow rate of blower in the multiple stages depending on the temperature difference between the set temperature and the vehicle compartment temperature and therefore can increase the air blow rate of the blower depending the temperature difference when the temperature difference is large and can reduce the air blow rate of the blower depending on such temperature difference when the temperature difference is small, on the contrary. Thereby the invention can quickly raise or lower the vehicle compartment temperature up to the set temperature.

[0048] Still further, an air conditioning apparatus for a vehicle of the present invention proportionally controls the upper limit value of the blower control input depending on the engine coolant temperature. Accordingly, the cool air is never blown out intensively within the vehicle and unpleasant feeling of user can be alleviated even when a user sets the vehicle compartment temperature to a higher value under the condition that the temperature condition within the vehicle is in the heat absorbing condition and the engine coolant temperature is low.

Claims

1. An air conditioning apparatus for a vehicle, comprising a blower provided within a air conditioning duct in the vehicle, a blower motor for driving the blower, a motor control circuit for controlling an output voltage to the blower motor and a microcomputer for controlling the air blow rate of the blower via the motor control circuit, wherein the microcomputer calculates temperature of air at the air blow-out port of the air conditioning duct, compares the calculated temperature of air at the air blow-out port with a first and a second reference temperatures previously stored and then calculates , when the temperature of air at the air blow-out port is lower than the first reference temperature or higher than the second reference temperature, an offset value of the air blow rate of the blower depending on the previously stored calculation formula and also calculates an offset value of the blower control input corresponding to the offset value of the air blow rate.

2. An air conditioning apparatus for a vehicle according to claim 1, wherein the offset value of the air blow rate is proportionally controlled depending on the difference between the calculated temperature at the air blow-out port and the first reference temperature or second reference temperature.

3. An air conditioning apparatus for a vehicle according to claim 1 or 2, wherein the first reference temperature and the second reference temperature are respectively set, with the microcomputer, to the temperature lower than or equal to the minimum temperature and to the temperature higher than or equal to the maximum temperature for the control of blower control input.

4. An air conditioning apparatus for vehicle according to any of claims 1 to 3, wherein the blower control input is

proportionally controlled in the multiple stages depending on the difference between the user preset temperature and the temperature within the vehicle.

5. An air conditioning apparatus for a vehicle according to any of claims 1 to 4, wherein the upper limit value of the blower control input is proportionally controlled depending on the temperature of engine coolant.

FIG. 1

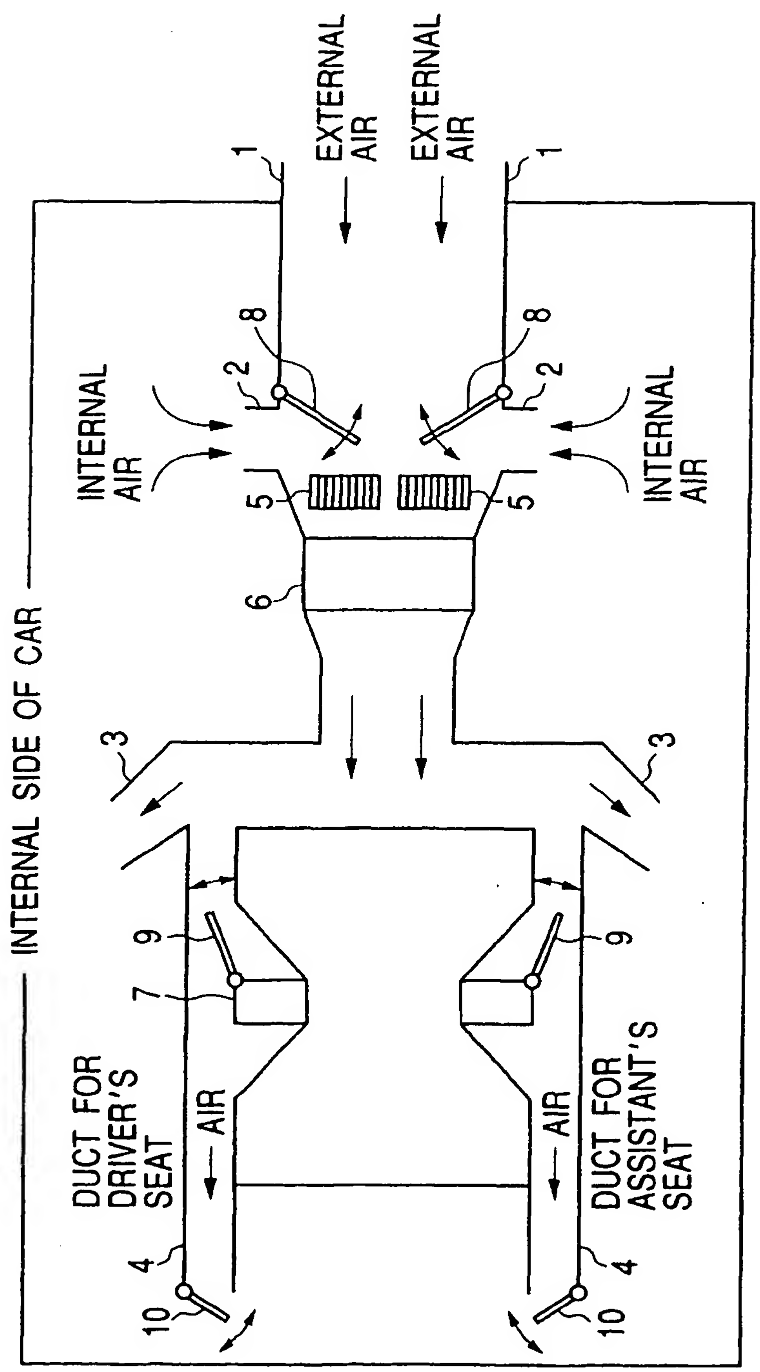

INTERNAL SIDE OF CAR
EXTERNAL AIR
EXTERNAL AIR
INTERNAL AIR
INTERNAL AIR
AIR
AIR
DUCT FOR DRIVER'S SEAT
DUCT FOR ASSISTANT'S SEAT
1
2
3
4
5
6
7
8
9
10

FIG. 2

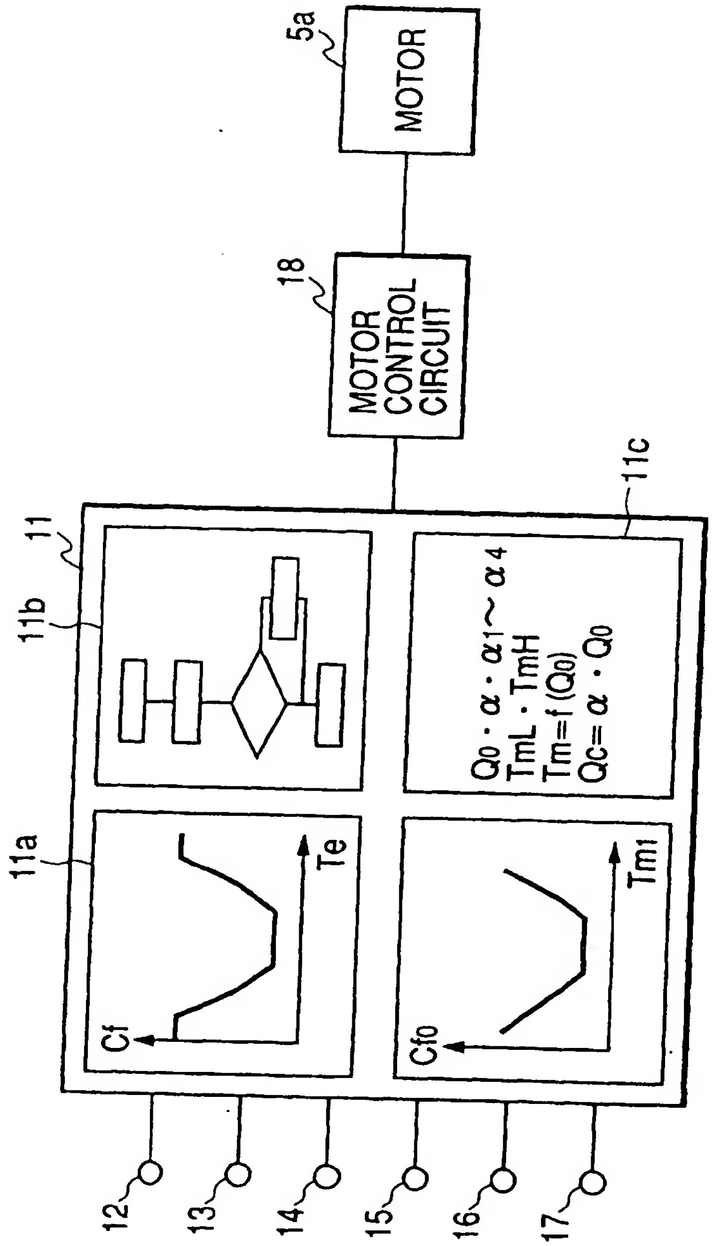

MOTOR
5a
MOTOR CONTROL CIRCUIT
18
11
11a
11b
11c
Cf
Te
Cf0
Tm1
Q0 · α · α1 ~ α4
TmL · TmH
Tm=f (Q0)
Qc= α · Q0
12
13
14
15
16
17

FIG. 3

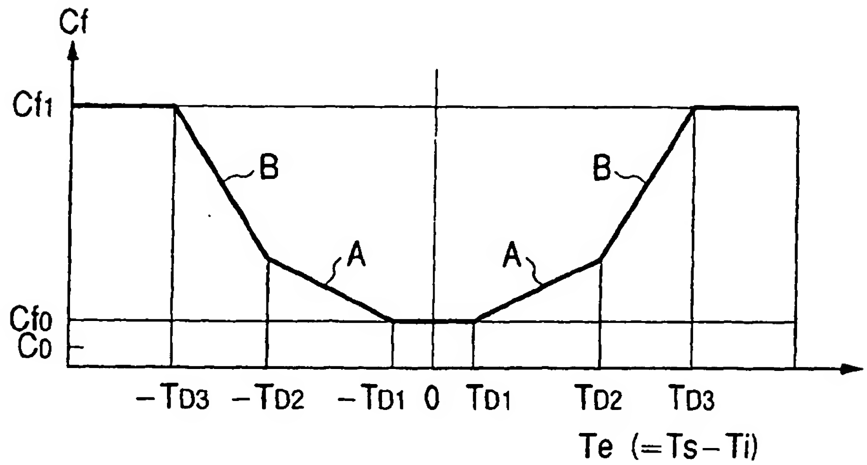

Cf
Cf1
B
B
A
A
Cf0
C0
-TD3 -TD2 -TD1 0 TD1 TD2 TD3
Te (=Ts-Ti)

FIG. 4

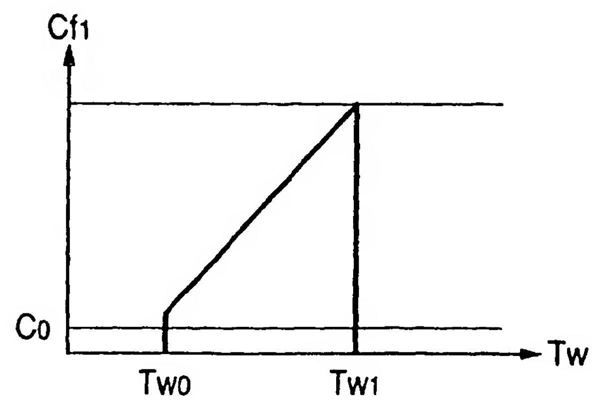

Cf1
C0
Tw
Tw0
Tw1

FIG. 5

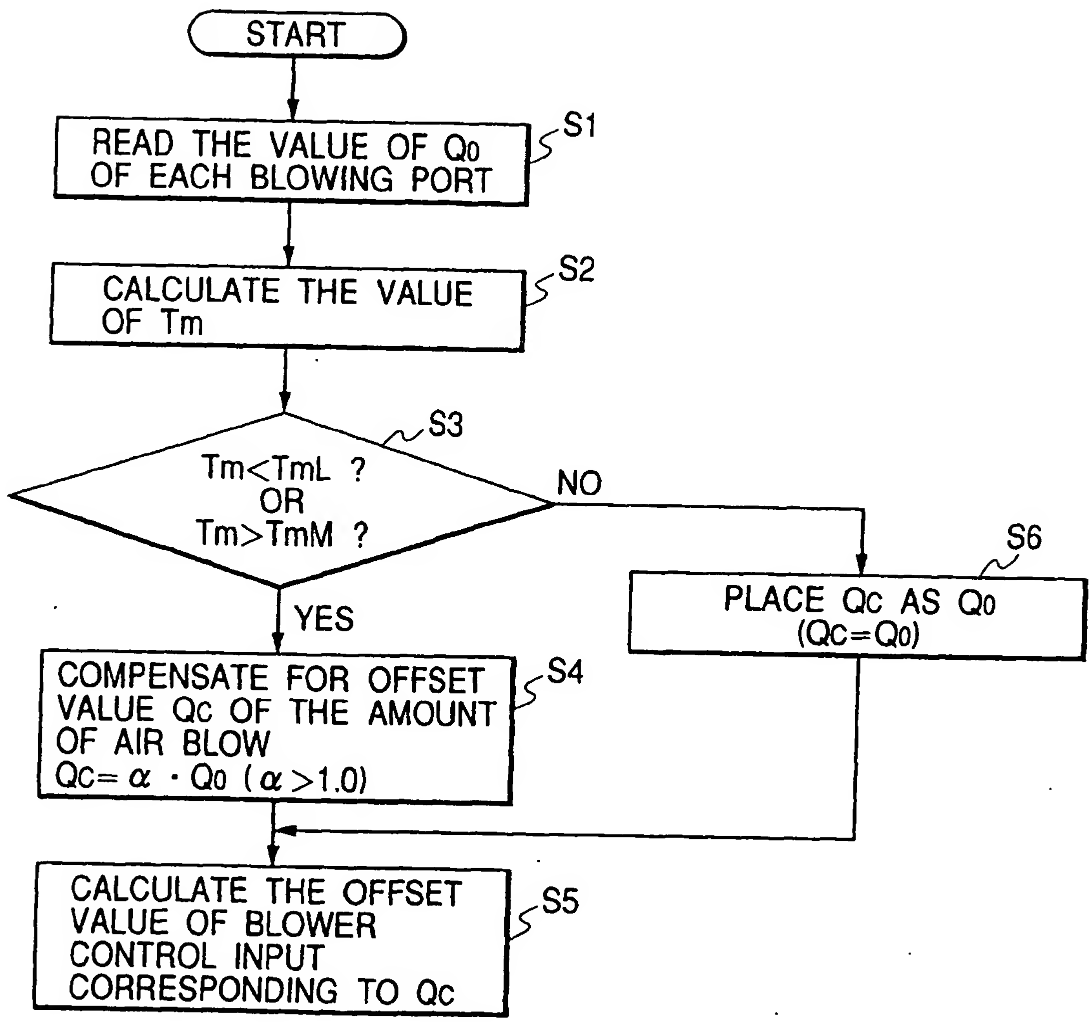

START
READ THE VALUE OF Q0 OF EACH BLOWING PORT
S1
CALCULATE THE VALUE OF Tm
S2
Tm<TmL ? OR Tm>TmM ?
S3
NO
YES
PLACE Qc AS Q0 (Qc=Q0)
S6
COMPENSATE FOR OFFSET VALUE Qc OF THE AMOUNT OF AIR BLOW Qc= α · Q0 (α >1.0)
S4
CALCULATE THE OFFSET VALUE OF BLOWER CONTROL INPUT CORRESPONDING TO Qc
S5

FIG. 6

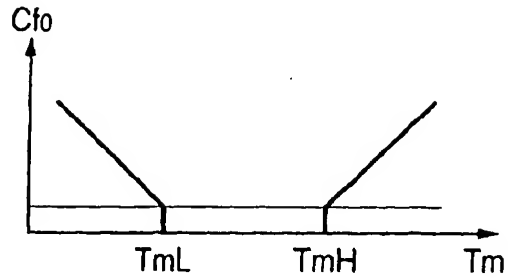


FIG. 7

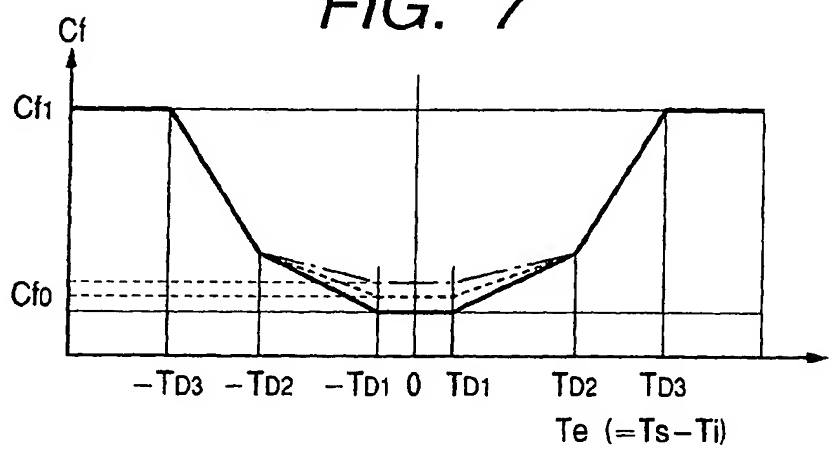
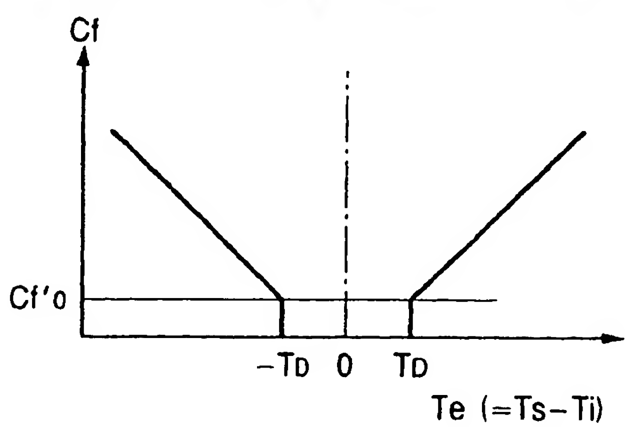


FIG. 8 PRIOR ART



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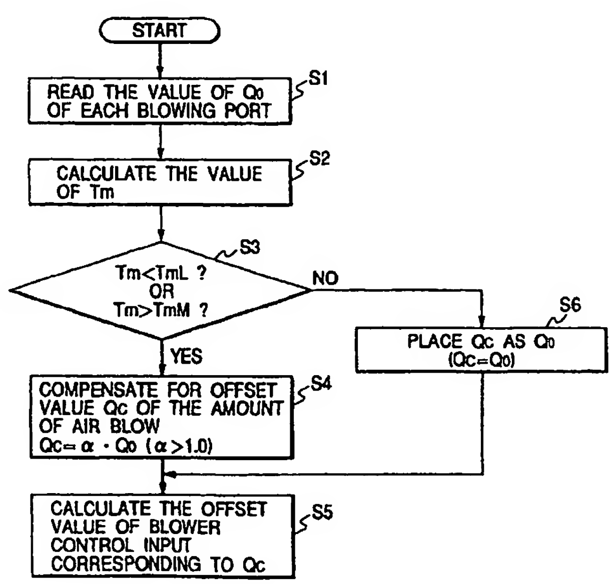
(54) Air conditioning apparatus for vehicle

(57) An air conditioning apparatus for a vehicle is constituted by including a blower (5) provided in the air conditioning duct of vehicle, a blower motor for driving the blower, a motor control circuit for controlling the voltage applied to the blower motor and a microcomputer (11) for controlling the air blow rate of the blower via the motor control circuit. The microcomputer calculates the air blow-out port temperature T_m of each air conditioning duct, compares this temperature with the previously stored first and second reference temperature T_{mL}, T_{mH}, calculates the offset value of the air blow rate of the blower depending on the previously stored calculation formula when the condition is determined as $T_m < T_{mL}$ or $T_m > T_{mH}$ and also calculates, from the relevant offset value, the offset value of the blower control input applied to the blower motor from the motor control circuit.

FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 01 10 3003

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 452 587 A (HONDA YUJI ET AL) 26 September 1995 (1995-09-26) * column 6, line 12 - column 9, line 49; figures 1-8 *	1	B60H1/00
A		2,4	

A	US 4 858 677 A (DOI SHIGETOSHI ET AL) 22 August 1989 (1989-08-22) * column 4, line 9 - column 8, line 61; figures 1-7 *	1,4,5	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B60H
G05D
F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 April 2003	Chlosta, P

CATEGORY OF CITED DOCUMENTS

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EP 01 10 3003

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-04-2003

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 5452587	A	26-09-1995	JP	7032854	A	03-02-1995
			DE	4425697	A1	26-01-1995
US 4858677	A	22-08-1989	JP	1020085	B	14-04-1989
			JP	1536185	C	21-12-1989
			JP	62299421	A	26-12-1987

EPO FORM P0459

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